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THE PHILIPPINE ISLANDS

CLIMATE

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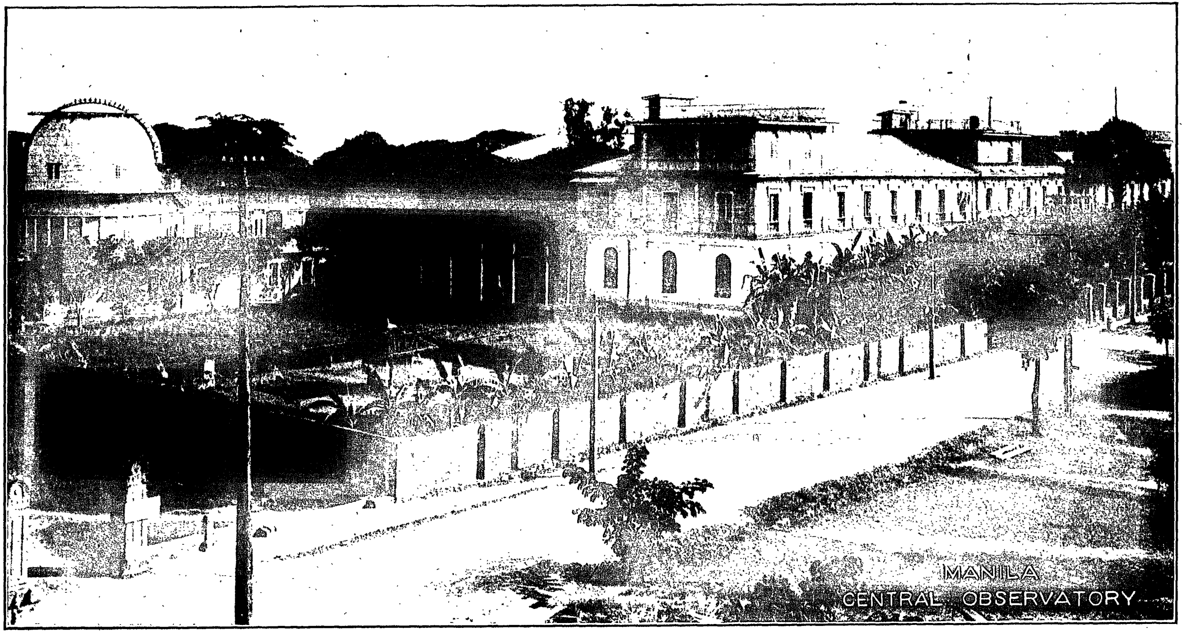

MANILA
CENTRAL OBSERVATORY

CLIMATE OF THE PHILIPPINES

By Rev. P. José Algué, *Director, Weather Bureau*

THE extension of the Philippine Archipelago from north to south of over 13 degrees in the Tropics, its division into nearly 3,000 islands, the varying form and area of these islands, some, as Luzon and Mindanao, covering an extent of over 30,000 square miles, 9 having a surface of between 1,000 and 6,000 square miles, 20 between 100 and 1,000, 73 between 1 and 10 square miles, with about 2,375 islets of less than 1 square mile each, and the relief of some of the largest islands, constituting various plateaus in the mountainous regions, give rise to a decided variety of climatic conditions which cannot be comprehended in a single or uniform type of climate. Therefore, in dealings with the climate of these Islands, I shall endeavor to classify it into different types which may represent approximately the different varieties of weather experienced in the various regions of the Archipelago. This attempt is to be necessarily empyrical or based on observation and experience. The basis for this classification is the local air currents as due to the relative position and size of the islands. The local air currents are caused by the various thermal conditions of the continents and oceans, or, in our case, of the islands and adjacent seas, and they are more or less independent from small differences of latitude; while the general air currents or trade winds are caused by the thermal differences between polar and equatorial regions, or they owe their existence to the normal differences of temperature corresponding to latitude.[1] How slight is the influence of the general currents or latitude alone on some of the climatic elements, for instance temperature, in the different regions of the Philippines, may be illustrated by the fact that the highest recorded temperature for seven years in Jolo, latitude, 6° 3′ N., is 36.5° C., and for eight years in Aparri, latitude 18° 22′ N., 37.8° C. Besides, the yearly mean maximum temperature for the same period is 30.6° C. in Jolo and 30.2° C. in Aparri, and the average mean temperature of the hottest months is 26.8° C. in Jolo and 28° C. in Aparri, and finally the yearly mean minimum temperature is 22.6° C. for Aparri, and 22.8° C. for Jolo. The difference therefore, of climatic conditions in the different parts of the Archipelago depends mostly on the local currents as a combined resultant of the general winds, position of the islands, and storm centers. Generally speaking, we may assume that the resultant direction of these currents in the Philippines is from north to east during the period October to January, from east to southeast from February to April, and for the rest of the year southerly directions ranging from southeast to southwest predominate, due chiefly to storm centers. We may add that such currents are the principal cause of the distribution of rain, which constitutes a very important factor of climate. We may further add that as the result of long

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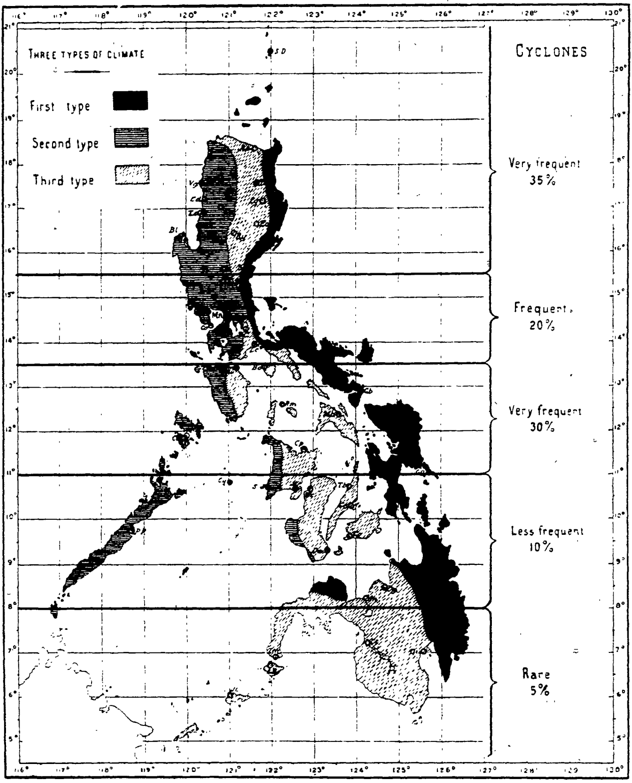
[1] See "The cyclones of the Far East," p. 123.

CLIMATE OF THE PHILIPPINE ISLANDS

Plate A



experience it may be stated that, in the Philippines, currents from northwest to west and southwest are generally either cyclonic or of cyclonic origin.[2] Hence, for the purpose of classification we shall divide the whole group of islands into regions directly influenced by northeasterly and easterly currents and regions not directly influenced by such currents. The climatic conditions observed in the first regions will constitute the first type of climate in the Philippines. The climatic conditions in the other regions will make the second type of climate in the Philippines. Besides, there are regions in the Philippines which are only in part affected by northeasterly and easterly currents and the climatic conditions of such regions may form another type of climate which we shall call intermediate climate.

There are, consequently, in the Philippines three types of climatic conditions which we may formulate as follows:

1. Climatic conditions over the small islands or portions of large islands at or near the sea level, below 80 meters of altitude, freely exposed to air currents from north to east or southeast and not distant from the Pacific Ocean.

2. Climatic conditions over the small islands or portions of large islands at or near the sea level not freely exposed to currents from north to east or southeast and distant from the Pacific Ocean.

3. Climatic conditions over the small islands or over portions of large islands only partly exposed to northeasterly and easterly currents, or, if exposed to such currents, distant from the Pacific Ocean.

Mountain climates may form another type of climate, but they can be reduced to some of the above types as far as some meteorological or climatological elements are concerned, except temperature which decreases with the altitude, and rain which increases with height, generally. Thus the climate of Baguio, Benguet, may be classified as of the second type, with lower temperature; the climate of Bontoc belongs also to the second type; the climate of the high plateaus in the Tayabas Province belong either to the first or to the intermediate type, with milder temperature; and, finally, the high plateaus in Mindanao, in the Misamis and Moro Provinces belong to the third or intermediate type, with lower temperature.

I will try to deduce the most characteristic features of each type from two instances of each and then give a list of places or regions under the same climatic conditions.

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[2] See "The cyclones of the Far East," p. 124 et seq.

FIRST TYPE—LEGASPI AND SURIGAO

LEGASPI

Climate of Legaspi.—We shall consider only the most important elements of climate viz, rainfall and its distribution throughout the year, cloudiness, humidity, and temperature; occasionally we will point out the effect of other elements, as wind and air pressure, to make each type better known.

The amount of rainfall will be given in millimeters, the temperature in degrees centigrade, the humidity in hundredths, and the amount of clouds according to the scale (0–10) as usual, 0 meaning entirely clear and 10 completely overcast.

Rain.—Distribution of rainfall (mean of seventeen years) per month is as follows: January, 377.6 mm.; February, 299.9 mm.; March, 172.6 mm.; April, 171 mm.; May, 132.8 mm.; June, 174.3 mm.; July, 261.1 mm.; August, 176.7 mm.; September, 250.4 mm.; October, 344 mm.; November, 348.7 mm.; December, 483.6 mm.; total, 3,192.7 mm.

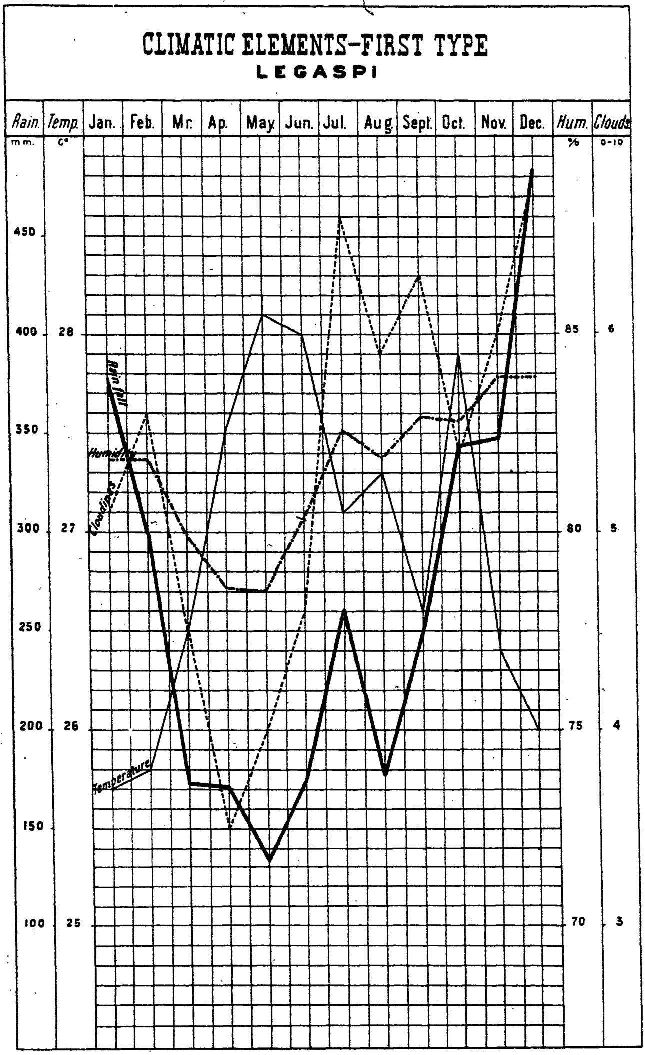
There is no dry season in Legaspi and the maximum amount of rain falls in December and the minimum in May. Rains of April and May are generally caused by thunderstorms and occasionally by cyclones. Rains from June to September are caused by electric and cyclonic storms. Rains from September to March are due to air currents from the Pacific.

Cloudiness.—Cloudiness follows closely the distribution of rain as per the following average monthly record: January, 5.1; February, 5.6; March, 4.5; April, 3.5; May, 4.0; June, 4.6; July, 6.6; August, 5.9; September, 6.3; October, 5.4; November, 6.0; and December, 6.8. Maximum cloudiness in December, minimum in April. Larger percentage of clouds from September to March due to prevalence of northeasterly and easterly currents. Clearest sky in April.

Humidity.—The average variation of the relative humidity per month is taken from hourly observations during the years 1908–1913: January, 81.8; February, 81.8; March, 79.9; April, 78.6; May, 78.5; June, 80.3; July, 82.6; August, 81.9; September, 82.9; October, 82.8; November, 83.9; and December, 83.9. Percentage of humidity corresponds to rainfall. Largest in December and November, lowest in April and May. Range of humidity rather small during the year on account of the even distribution of rain. Mean maximum percentage 98 per cent, and the mean of the minimum 56 per cent. Therefore, the mean range of the average extremes of humidity is 42 per cent. The greatest amount of relative humidity recorded in Legaspi in eleven years is

100 in December, 1910, and the lowest is 43 per cent in August, 1908.

Plate I.



Temperature.—The average changes of temperature in Legaspi are taken from hourly observations as for the relative humidity: January, 25.7; February, 25.8; March, 26.5; April, 27.5; May, 28.1; June, 28; July, 27.1; August, 27.3; September, 26.6; October, 27.9; November, 26.4; and December, 26; mean 26.8. Lowest mean temperature in January. Coolest months, November, December, January, and February during the prevalence of northeasterly currents. Range of average monthly temperature 2.4 from January the lowest to May the highest. Highest recorded temperature in a period of eleven years, 37.2 in May, 1912; lowest temperature registered during the same period, 16.9 in February, 1905. Yearly mean maximum temperature, 32.5. Yearly mean minimum temperature, 21.8

SURIGAO

Rainfall.—The average monthly rainfall in Surigao for ten years is: January, 334 mm.; February, 400.2 mm.; March, 265.6 mm.; April, 271.6 mm.; May, 116.3 mm.; June, 114.2 mm.; July, 160.6 mm.; August, 90.4 mm.; September, 172.3 mm.; October, 238.4 mm.; November, 419.6 mm.; and December, 550.5 mm.; total, 3,133.7 mm.

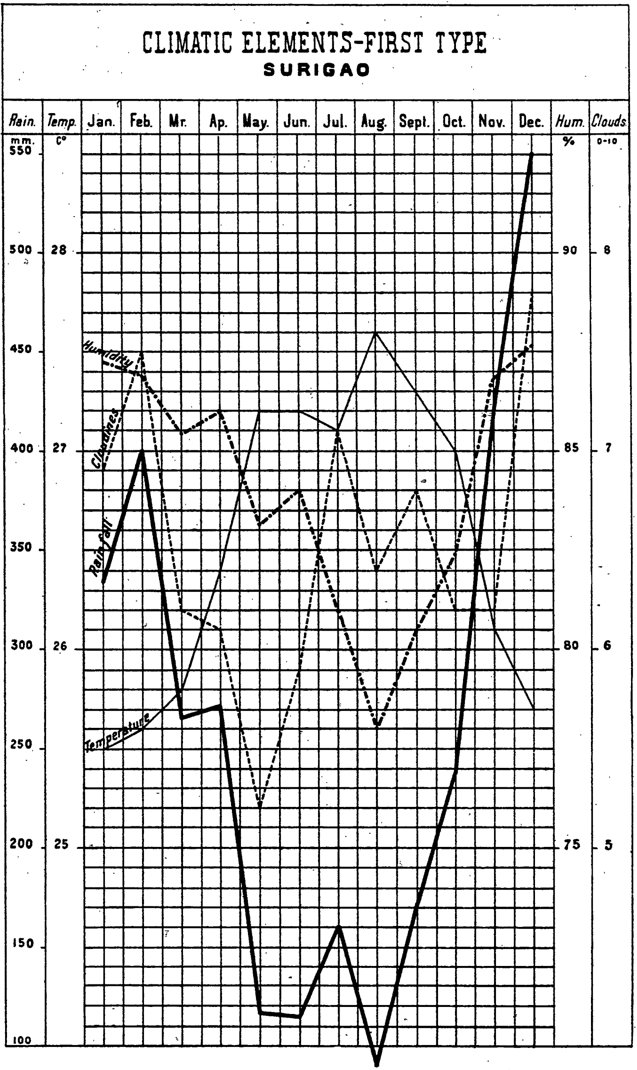
There is no dry season in Surigao. Greatest rainfall in December. Most abundant rainfall in November, December, January, February, and March, owing to the prevalence of northerly and easterly winds. Less rain than in Legaspi during June, July, August, and September. Total average rainfall slightly less than that of Legaspi, owing to its position south and distant from the general track of typhoons which usually from June to September cross the Islands through higher parallels.

Cloudiness.—The monthly average amount of clouds is the following: January, 6.9; February, 7.5; March, 6.2; April, 6.1; May, 5.2; June, 5.9; July, 7.1; August, 6.4; September, 6.8; October, 6.2; November, 6.2; and December, 7.8; mean 6.5. Maximum amount of clouds in December as in Legaspi.

Humidity.—The monthly percentage of humidity runs as follows: January, 87.3; February, 86.9; March, 85.4; April, 86.5; May, 83.1; June, 84; July, 81; August, 78; September, 80.5; October, 82.4; November, 86.8; and December, 87.7; mean 84.1.

This monthly variation of the monthly percentage of humidity is taken from six daily observations during the last six years in order to make it more comparable with the results from other stations. There is a small range of humidity during the year. Maximum percentage in December due to maximum rainfall and maximum cloudiness. Minimum percentage in August corresponding to the small average of clouds and minimum rainfall with prevalence of light southerly winds. Mean of maximum humidity, 97.2

Plate II.



CLIMATIC ELEMENTS-FIRST TYPE
SURIGAO

per cent; mean of maximum, 59.8 per cent; absolute maximum, 99 per cent in February, 1909, October and December, 1912, and in January and February, 1913; absolute minimum, 40 per cent in September, 1912.

Temperature.—The average monthly changes of temperature are: January, 25.5; February, 25.6; March, 25.8; April, 26.4; May, 27.2; June, 27.2; July, 27.1; August, 27.6; September, 27.3; October, 27; November, 26.1; December, 25.7; mean 26.5. Highest mean temperature in August; lowest in January, corresponding to the amount of rainfall. Mean of absolute maximum temperatures 33. Mean of absolute minimum 21.6. Absolute maximum recorded, 36 in July, 1913; absolute minimum, 18.5 in February, 1913.

The climatic conditions in Surigao are similar to those in Legaspi. There is a slight difference in the rainfall for the months of June, July, August, and September for the reason already given. The most important climatic elements of Legaspi and Surigao are graphically represented in plates one and two.

The distribution of rainfall being in the Tropics almost the controller of climate, we give in Table A the average monthly rainfall in all available places located in regions affected by the first type of climate.

From the observations of Legaspi and Surigao and from the foregoing table we may deduce the principal features of the first type of climatic conditions.

First. There is practically no dry season in this type of climate. The greatest amount of rain falls generally in December and January during the prevalence of northeasterly winds. In regions south of parallel 10° N., where the winds from west to south can not attain or do not attain usually great force or frequency, the rain, during the so-called typhoon season, is less abundant than during the prevalence of northeasterly or easterly winds in December, January, February, and March. The result is that there is generally an average rainfall for the year less in regions south of parallel 10° N.

Second. The percentage of the rainfall from October to February is nearly 50 per cent of the annual rainfall, and the percentage of rainfall from June to October never reaches 50 per cent of the rainfall for the whole year, especially in regions south of parallel 10° N.

Third. Cloudiness follows the distribution of rain. December and January, cloudy and rainy; the clearest months being April and May.

Fourth. The relative humidity has small range during the year, the percentage increases gradually from September to

TABLE A.—*Table of average monthly rainfall, first type*

Station.	Island.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
		mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
Atimonan	Luzon	216.5	135.2	78.5	96.4	158.2	143.8	229.0	156.1	306.9	386.5	446.4	358.5	2,712.0
Albay	do	233.5	168.2	229.0	155.4	188.3	207.6	266.2	242.1	299.8	212.5	301.0	457.0	2,960.6
Baler	do	259.2	122.0	189.0	329.1	300.1	239.2	318.8	162.5	326.7	336.9	345.6	372.8	3,301.9
Borongan	Samar	471.8	437.8	217.5	249.5	240.2	236.9	205.1	121.9	209.0	345.7	498.1	593.8	3,827.3
Butuan	Mindanao	181.5	244.1	147.6	122.0	126.5	151.1	129.6	98.9	136.2	162.9	287.9	317.5	2,105.8
Calbayog	Samar	144.3	178.2	103.1	107.9	166.6	146.9	200.1	188.0	287.9	255.5	284.6	261.8	2,324.9
Caraga	Mindanao	294.8	402.4	270.3	148.5	203.7	103.6	142.7	75.7	67.4	128.4	171.9	422.6	2,432.0
Dapitan	do	118.4	123.3	55.7	110.2	70.9	117.7	151.6	89.3	141.6	246.0	369.7	277.4	1,871.8
Gubat	Luzon	313.4	290.4	181.5	89.8	113.9	123.1	178.4	93.6	189.9	274.0	410.8	495.2	2,754.0
Laoang	Samar	429.6	379.9	260.0	117.0	97.3	162.2	257.4	84.3	174.7	267.6	510.5	545.0	3,285.5
Legaspi	Luzon	377.6	299.9	172.6	171.0	132.8	174.3	261.1	176.7	250.4	344.0	348.7	483.6	3,192.7
Maasin	Leyte	138.5	184.8	96.5	65.3	93.7	141.8	282.1	209.2	292.0	235.6	315.8	309.0	2,364.3
Nueva Caceres	Luzon	107.3	105.9	42.1	69.4	98.8	172.9	300.0	161.1	263.1	300.1	275.2	302.1	2,198.0
Ormoc	Leyte	176.7	100.7	78.3	65.8	72.8	177.2	324.9	288.0	308.5	257.5	219.6	180.7	2,250.7
Paracale	Luzon	313.0	285.1	257.7	103.6	148.5	158.2	480.1	190.8	236.0	564.9	424.0	369.4	3,531.3
San Antonio	do	190.0	106.5	122.9	107.4	170.4	195.1	275.6	267.6	362.8	355.4	380.6	338.5	2,872.8
Santo Domingo	Batanes	234.0	117.1	119.5	131.4	238.1	160.3	301.8	386.3	367.3	330.6	320.0	363.0	3,069.4
Surigao	Mindanao	334.0	400.2	265.6	271.6	116.3	114.2	160.6	90.4	172.3	238.4	419.6	550.5	3,133.7
Tacloban	Leyte	224.1	223.9	117.8	143.0	144.3	196.2	202.2	147.1	157.3	206.2	290.2	353.3	2,405.8
Virac	Catanduanes	167.8	263.9	147.5	134.2	135.1	196.9	318.0	110.0	162.3	287.5	398.7	406.1	2,727.7
Mean		246.3	228.5	157.6	139.4	150.8	166.0	249.3	167.0	235.6	286.8	350.9	387.9	2,766.1

December. Mean percentage for the whole year less than 85 per cent.

Fifth. The temperature of the Archipelago may be classified as of three kinds—high, intermediate, and mild. Regions of high temperature have a mean annual temperature greater than 27; those of intermediate temperature have an annual mean of less than 27; and in regions of mild temperature the average yearly mean is less than 26. Now, in regions of the first type of climatic conditions the mean annual temperature never exceeds 27 and consequently they enjoy either an intermediate or mild temperature.

The regions which enjoy climatic conditions like those of Legaspi and Surigao are north of parallel 10° N.

The southeast end of Luzon or the Provinces of Albay and Sorsogon.

The Province of Ambos Camarines and adjacent islands.

The Island of Catanduanes.

The eastern coast of Luzon from the seashore to the range of mountains in the Province of Tayabas, eastern Isabela, and the eastern Cagayan.

The northern and eastern coast of Samar and adjacent islands.

The San Bernardino Strait and adjacent islands.

The eastern coast of Leyte and adjacent islands.

Dinagat and Siargao and adjacent islands.

The small islands on the interisland sea between Panay and Luzon east of longitude 122° E. south of parallel 10° N.

The peninsula of Surigao to the mouth of Agusan River.

The eastern coast of Mindanao and the great valley of the Agusan River.

On the northern coast of Mindanao, the most northern parts of Misamis Province, and adjacent islands.

All these regions are easily accessible to wet currents direct from the Pacific.

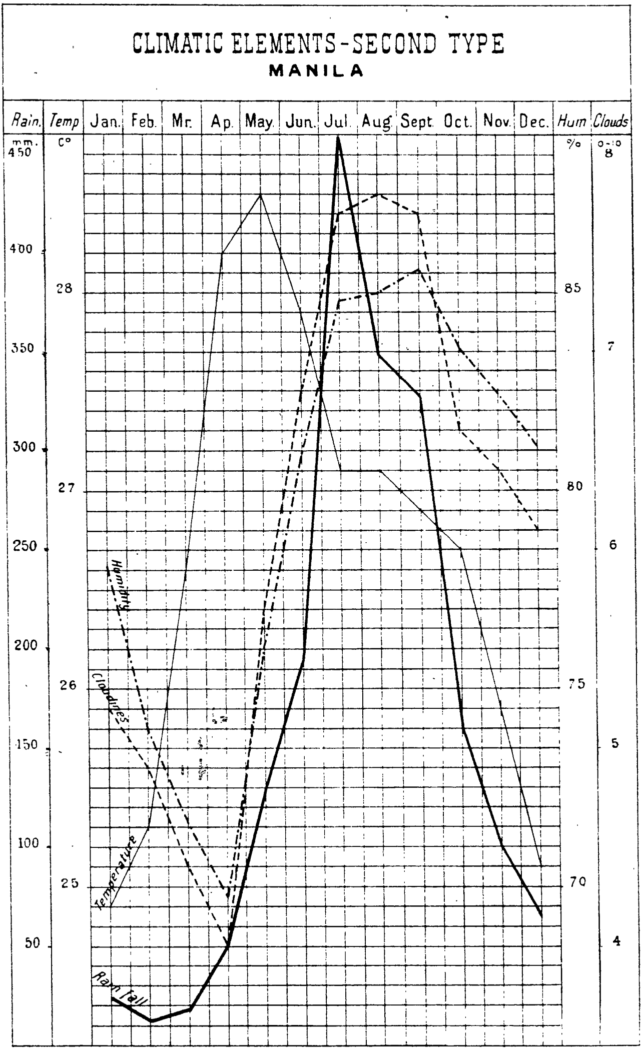
SECOND TYPE—MANILA AND DAGUPAN

MANILA

Rainfall.—The average monthly distribution of rainfall in Manila is (mean of forty-nine years): January, 24 mm., February, 11.9 mm.; March, 17.1 mm.; April, 50.2 mm.; May, 128.5 mm.; June, 193.8 mm.; July, 459.4 mm.; August, 347.1 mm.; September, 326.2 mm.; October, 162.7 mm.; November, 100 mm.; and December, 65.3 mm.; total, 1,886.2 mm.

There is a dry season in Manila lasting from December to April. Greatest rainfall in July and August. Driest months February and March. The rainfall of December is the greatest in the dry season, due to occasional frequency and prevalence of northeasterly currents over Manila. The abundant rainfall in June, July, August, September, October,

Plate III.



CLIMATIC ELEMENTS-SECOND TYPE

MANILA

and November is caused either by cyclones or by electric storms or by both; most frequently the rainfall of April and May is due to electric storms.

Cloudiness.—The average monthly cloudiness in Manila for a period of thirty years is the following: January, 5.2; February, 4.9; March, 4.4; April, 4; May, 5.7; June, 6.8; July, 7.7; August, 7.8; September, 7.7; October, 6.6; November, 6.4; and December 6.1; mean, 6.1. Average cloudiness is increasing from April, where it reaches the minimum, to August, the most cloudy month. It decreases rapidly from September to April.

Humidity.—The percentage of the relative humidity in Manila for a period of thirty years is: January, 78.1; February, 74; March, 71.6; April, 69.7; May, 76.1; June, 80.9; July, 84.8; August, 85; September, 85.6; October, 83.6; November, 82.4; and December, 81.1; mean, 79.4.

Mean relative humidity is lower in regions of the first type on account of the prevalence of the dry season and the annual range of this element is greater than in the regions mentioned, for the same reason. Highest percentage of humidity in September, lowest in April. Absolute maximum of relative humidity recorded, 100; absolute minimum, 27 per cent, registered in May, 1912; absolute range for a period of thirty years, 73 per cent; average humidity of hottest months for a period of eleven years, 74.4 per cent; average of coolest months, 78.5.

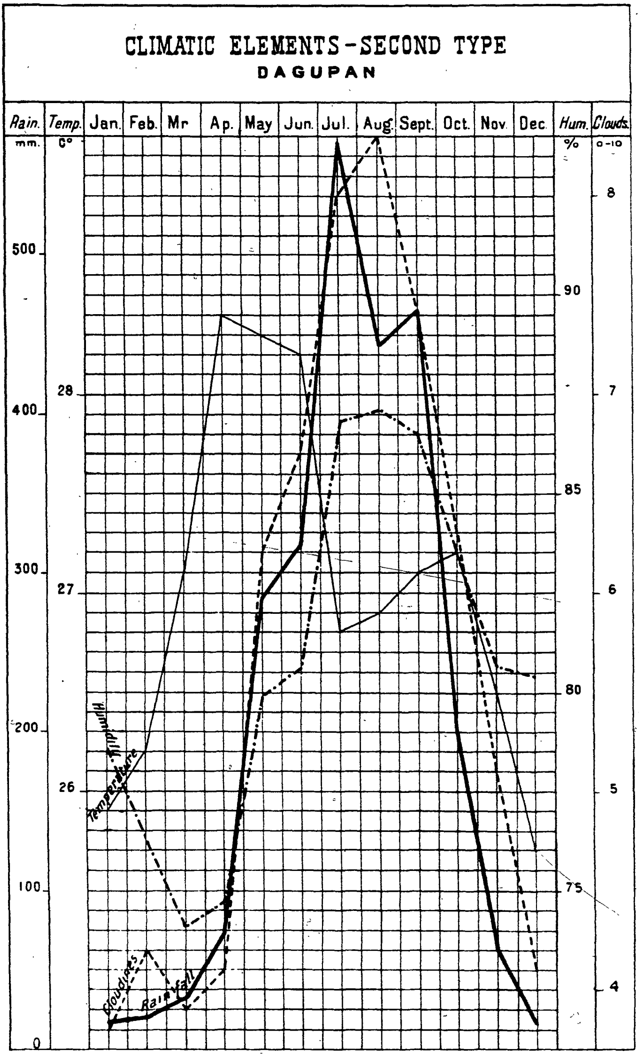
Temperature.—The average mean monthly temperature for a period of thirty years is: January, 24.9; February, 25.3; March, 26.6; April, 28.2; May, 28.5; June, 27.9; July, 27.1; August, 27.1; September, 26.9; October, 26.7; November, 25.9; and December, 25.1; mean, 26.7. Coolest months, January and February; hottest months, April, May, and June. Maximum temperature recorded in a period of forty-nine years, 39.7 in May, 1878; minimum registered, 12.1 in December, 1870, during the same period; absolute range of temperature for the period of forty-nine years, 27.6.

Monthly average of the maximum temperatures for a period of twenty-nine years: January, 30.1; February, 30.8; March, 32.4; April, 33.8; May, 33.5; June, 32.4; July, 30.9; August, 30.7; September, 30.6; October, 31.1; November, 30.3; and December, 29.9; mean, 31.4.

Monthly average of minimum temperatures: January, 20.4; February, 20.3; March, 21.3; April, 22.7; May, 23.9; June, 23.9; July, 23.7; August, 23.7; September, 23.6; October, 23.1; November, 22.2; and December, 21.2; mean 22.5. Average yearly range of extreme temperatures in Manila, 8.9.

Rainfall.—The monthly distribution of rainfall in Dagupan is: January, 10.7 mm.; February, 19 mm.; March, 30.2 mm.;

Plate IV.



CLIMATIC ELEMENTS-SECOND TYPE
DAGUPAN

April, 72.8 mm.; May, 283.6 mm.; June, 317.6 mm.; July, 570.1 mm.; August, 442.9 mm.; September, 465.1 mm.; October, 198.8 mm.; November, 61.6 mm.; and December, 15 mm.; total, 2,541.4 mm. Average monthly rainfall lowest in November and December due to the absence of northeasterly currents and because the typhoon tracks by that time cross through lower parallels. This is the case in regions of the second type north of parallel 15°, as a glance at TABLE B will show. Slight precipitation in January, February, March, and April owing to the absence of easterly currents. Very abundant rainfall during June to October due to cyclonic and electrict storms and to the prevalence of southerly currents. Rainfall in May is almost exclusively due to electric storms.

Cloudiness.—The amount of clouds is distributed as follows: January, 3.8; February, 4.2; March, 3.9; April, 4.1; May, 6.2; June, 6.7; July, 8.0; August, 8.3; September, 7.4; October, 6.3; November, 5.1; and December, 4.1; mean, 5.4. Clearest sky in January due to the absence of easterly currents. Most cloudy months, August and September. Mean cloudiness similar to that of Manila.

Humidity.—The monthly percentage of relative humidity is: January, 78.6; February, 76.3; March, 74.1; April, 74.7; May, 79.9; June, 80.6; July, 86.8; August, 87.1; September, 86.5; October, 83.4; November, 80.7; December, 80.4; mean, 80.7.

Driest month, March; wettest, August and July. Maximum percentage, 100 during the rainy season; minimum, 28 in March, 1908. Range of percentage rather great due to the decided division of dry and wet seasons.

Temperature.—The average monthly temperature is: January, 25.9; February, 26.2; March, 27.1; April, 28.4; May, 28.3; June, 28.2; July, 26.8; August, 26.9; September, 27.1; October, 27.2; November 26.5; and December, 25.7; mean, 27.1.

Warmest month, April; coolest, December. Absolute maximum temperature in eleven years, 39.5 in May, 1906; minimum recorded during the same period, 14.3 in January, 1907, when there was a spell of cool weather over western Luzon; range of average monthly temperatures during the year, 2.5; absolute range of extreme temperature during the period mentioned, 25.2; mean daily range during January 16.9, during April 17.2, and during September 12.5.

We give in Table B the distribution of rainfall in the most important places located in the regions of the second type of climate.

TABLE B.—*Table of average monthly rainfall, second type*

Station.	Island.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
		mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
Arayat	Luzon	10.2	6.7	8.0	27.6	131.2	240.9	373.5	212.8	307.0	223.0	59.5	38.0	1,638.4
Baguio	do	37.9	15.4	38.9	116.3	447.1	403.4	1,003.2	1,027.9	864.8	456.7	90.1	54.4	4,556.1
Balanga	do	18.2	7.3	7.0	51.6	248.6	292.4	596.1	484.2	404.5	233.4	65.9	33.2	2,442.4
Batangas	do	16.8	23.4	7.5	28.3	124.7	96.8	306.6	171.3	293.2	183.1	214.0	99.1	1,564.8
Bolinao	do	10.1	12.7	13.2	45.4	254.2	395.7	776.1	622.0	523.3	177.9	48.5	15.7	2,894.8
Biñang	do	7.5	18.0	0.0	9.0	62.1	294.0	280.2	125.2	148.6	132.1	46.0	175.3	1,298.0
Cabo Santiago	do	6.5	0.2	5.7	4.6	99.4	186.9	368.2	239.9	321.5	120.8	101.6	57.5	1,512.8
Candon	do	4.7	6.4	11.7	13.4	232.0	334.2	686.3	548.4	488.6	186.2	53.1	12.9	2,578.2
Cavite	do	22.4	9.8	3.1	7.7	23.8	268.6	224.6	198.8	314.4	104.2	60.1	96.6	1,334.1
Corregidor	Corregidor	18.0	2.9	1.5	16.8	163.4	308.2	536.3	503.7	415.3	203.3	72.1	41.4	2,282.9
Cuyo	Cuyo	11.3	14.2	1.6	20.4	159.2	261.0	420.8	383.5	415.9	227.8	135.4	54.7	2,105.8
Dagupan	Luzon	10.7	19.0	30.2	72.8	283.6	317.6	570.1	442.9	465.1	198.8	61.6	15.0	2,487.4
Iba	do	10.7	5.9	37.8	73.6	302.8	382.8	1,130.2	947.0	832.4	175.9	35.5	17.5	3,952.1
Laoag	do	1.7	9.2	4.2	10.3	157.0	241.0	636.6	659.5	733.6	269.0	36.6	26.9	2,785.6
Mamburac	Mindoro	3.2	2.3	9.4	29.9	271.8	595.0	327.0	997.0	485.4	323.2	48.2	23.6	3,116.0
Manila	Luzon	24.0	11.9	17.1	50.2	128.2	193.8	459.4	347.1	326.2	162.7	100.0	65.3	1,886.2
Marilao	do	11.3	6.3	8.1	48.6	154.5	360.6	545.1	372.5	280.1	183.2	59.1	73.9	2,103.1
Masinloc	do	0.8	0.0	5.5	85.9	125.7	1,135.1	992.9	758.8	518.9	247.4	63.4	20.0	3,954.4
Olongapo	do	8.4	0.9	4.7	34.4	256.5	474.1	750.9	775.9	572.6	198.1	77.9	34.7	3,189.1
Porac	do	10.6	6.9	31.3	64.3	292.1	310.2	646.0	311.6	356.7	225.6	75.6	34.5	2,365.4
Punta Restinga	do	1.6	1.2	12.2	13.5	176.5	289.0	592.8	329.9	633.1	123.5	105.9	29.3	2,308.5
San Fernando Union	do	12.2	6.0	8.4	17.9	178.7	291.8	540.4	661.7	443.3	140.9	42.9	9.4	2,353.6
San Isidro	do	17.6	4.2	8.2	44.6	182.3	208.6	370.1	289.8	321.4	196.3	84.2	39.2	1,766.5
San Jose Buenavista	Panay	30.9	13.6	18.3	45.7	142.6	333.4	587.7	517.2	546.5	316.6	180.7	59.7	2,792.9
Silang	Luzon	39.3	20.4	23.1	55.2	177.5	242.2	477.1	377.0	351.8	179.3	147.4	120.4	2,210.7
Tarlac	do	7.5	9.6	21.9	65.8	185.7	224.2	418.8	339.4	350.6	191.4	81.7	42.5	1,939.1
Vigan	do	0.4	3.1	5.8	32.7	218.8	347.9	699.6	719.3	579.4	185.2	20.2	9.5	2,821.9
Mean		13.1	8.8	12.8	40.2	191.9	334.4	567.3	495.0	455.3	206.1	80.3	48.2	2,453.4

The principal elements of the climate of Manila and Dagupan are shown graphically in Plates III and IV.

From the observations of Manila and Dagupan and from Table B we may deduce the most important climatic conditions of the second type.

First. There is a distinct wet and dry season in this type, the dry lasting generally from the end of November to March.

Second. The percentage of rainfall during the months from June to October, popularly called the "rainy season," is at least 76 per cent of the total precipitation of the year, while the rainfall from November to February never exceeds 12 per cent of the total average. May and April are apt to have more precipitation than the dry months, owing to electric storms, and occasionally, especially in May, to cyclones.

Third. Amount of clouds follows precipitation or rather shows the average precipitation. Clearest months from January to April, cloudiest months September, August, and July.

Fourth. The annual percentage of humidity is not very high owing to the influence and duration of the dry season. Annual percentage is not more than 80 per cent. The range of the monthly percentage is considerably greater, while the average for the year is less than in regions of the first type.

Fifth. The temperature in these regions is either high or intermediate, seldom or never mild, according to the classification made above.

The regions which have climatic conditions similar to those of Manila and Dagupan are:

The western coast of Luzon from Cape Bojeador to Cape Santiago or the Provinces of Ilocos Norte, Ilocos Sur, Union, Zambales, Bataan, and Batangas.

The Provinces of Rizal, western Bulacan, Pampanga, Nueva Ecija, Tarlac, and Pangasinan, the Lingayen Gulf, and adjacent islands.

The western coast of Mindoro and adjacent islands.

The western coast of Panay.

The islands in the north Sulu Sea and north of Paragua.

The Palawan and adjacent islands.

These regions are far distant from the Pacific ocean or they do not get the influence of the currents from that ocean except through considerable portions of land.

THIRD TYPE—APARRI AND CEBU

APARRI

Rainfall.—The average monthly rainfall is: January, 186.1 mm.; February, 81 mm.; March, 47.6 mm.; April, 47.8 mm.; May, 122.3 mm.; June, 142.1 mm.; July, 205.8 mm.; August, 246.9 mm.; September, 298 mm.; October, 329.7 mm.; November, 304.4 mm.; and December, 241.8 mm.; total 2,253.5 mm.

The largest amount of rainfall occurs from September to January; maximum fall in November, minimum in March. Precipitation diminishes as the wind veers to the east from January to March and then an imperfect dry season, very short, occurs, in March or April. Rain less abundant than in regions of the first type during the prevalence of easterly winds, but more abundant than in the regions of the second type during the months of February, March, and April, especially in the interior and western part of Mindanao, except the Zamboanga Peninsula and Basilan with the adjacent islands.

Cloudiness.—The amount of clouds agrees with the distribution of rain. January, 6.1; February, 6.1; March, 4.3; April, 2.9; May, 4.7; June, 4.3; July, 6.0; August, 6.0; September, 5.1; October, 5.8; November, 5.9; and December, 6.6; mean, 5.3. Clearest sky in April, cloudiest in December. Amount of cloudiness generally less than in regions of type first and second. Range of cloudiness greater as a consequence. Average similar to regions of the first type north of parallel 10° N.

Humidity.—The mean monthly humidity is as follows: January, 83.9; February, 81.5; March, 81.4; April, 81.1; May, 81.6; June, 80; July, 82.2; August, 83.1; September, 83.4; October, 84.1; November, 84.1; and December, 83.5; mean, 82.5.

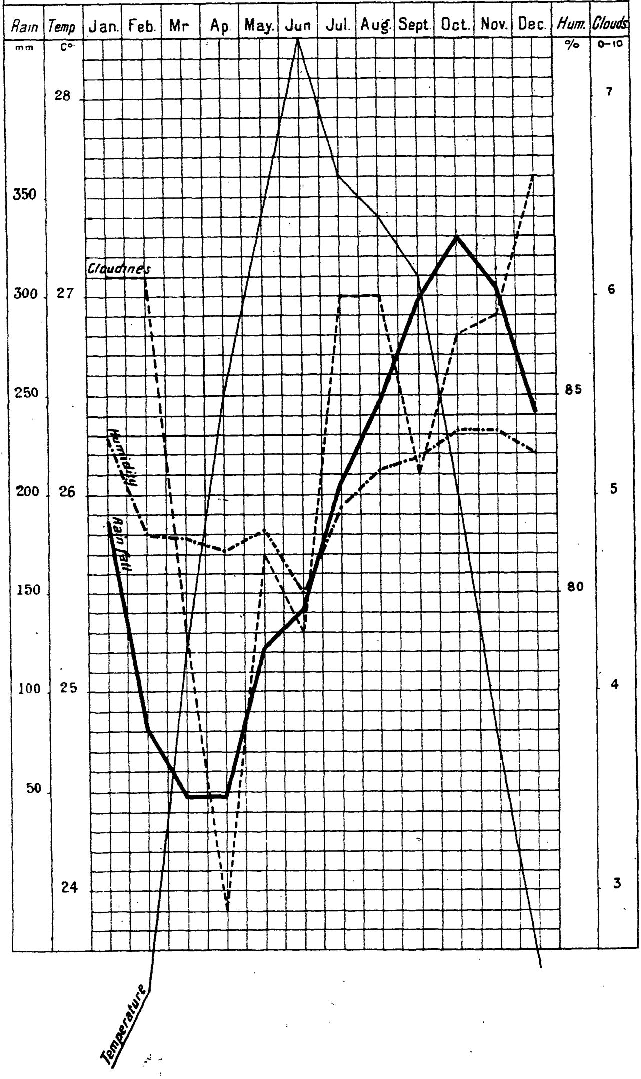
The percentage of humidity is higher than in regions of the first type with smaller range during the year. The average mean monthly maximum, 96.7 per cent; the average mean monthly minimum, 57 per cent; the average daily range of humidity 40 per cent. The greatest percentage of relative humidity recorded in a period of six years, 99 per cent in June, 1909, and in February, 1913; lowest, 45 per cent in February, 1910, and in March, 1912.

Temperature.—The average monthly temperature in Aparri is: January, 23.1; February, 23.5; March, 25.2; April, 26.5; May, 27.4; June, 28.3; July, 27.6; August, 27.4; September, 27.1; October, 26; November, 24.7; and December, 23.6; mean 25.8. Coolest month, January; warmest, June.

Plate V.

CLIMATIC ELEMENTS-THIRD TYPE (INTERMEDIATE)

APARRI



Range of monthly mean temperature during the year, 5.2; average daily range of temperature during February, 14.2; average daily range in July, 12.2° C. Yearly mean maximum temperature 31.6° C.; yearly mean minimum temperature, 21.5° C.; range of the extreme mean temperatures, 10.1° C.; highest recorded temperature in eleven years, 37.8° C. in May, 1903; lowest registered temperature during the same period, 15.5° C. in February, 1905; absolute range of temperature, 22.3° C.

CEBU

Rainfall.—The average rainfall per month in Cebu is: January 93.3, mm.; February, 76.7 mm.; March, 47.2 mm.; April, 38.8 mm.; May, 87.5 mm.; June, 167.6 mm.; July, 185.1 mm.; August, 136.1 mm.; September, 179.8 mm.; October, 219.4 mm.; November, 162.2 mm.; and December, 149 mm.; total, 1,542.7 mm.

Very short dry period, as in Aparri, lasting practically only one month, April. Largest amount of rain in July, mostly due to cyclonic storms. Rain increasing with northeasterly winds from October to November and December, moderating in January, February, and March, as the winds veer to southeast. Rainfall less than in Aparri in July, August, September, and October due to its position south which is more distant from cyclonic tracks during that period. Total rainfall less than in types first and second.

Cloudiness.—The average amount of clouds per month is: January, 4.7; February, 5.2; March, 4.3; April, 4.0; May, 4.8; June, 5.4; July, 6.1; August, 5.7; September, 5.9; October, 5.6; November, 5.3; and December, 5.4; mean, 5.2.

Amount of clouds in Cebu agrees very closely with that of Aparri, the distribution, however, is slightly different, the maximum corresponding to July as the rainfall and the minimum to April. The range of cloudiness is less in Cebu than in Aparri. The sky is much clearer in Aparri than in Cebu in April, but just the reverse during December and January, owing to the lesser influence of northeasterly winds in Cebu.

Humidity.—The percentage of the relative humidity in Cebu is: January, 76.1; Fberuary, 77.2; March, 73.5; April, 73.4; May, 74.2; June, 75.7; July, 76.7; August, 76.5; September, 77.5; October, 78.9; November, 78.2; and December, 78.3; mean, 76.2. The percentage of humidity is higher in October, November, and December owing to the influence of northeasterly and easterly high currents, the driest month being April. There is a very small range of humidity during the year owing to the short dry season. Cebu is generally dryer than other places more directly exposed to winds from the Pacific. Currents from the Pacific reach Cebu through Samar and Leyte islands and the passage overland modifies the hygrometric conditions of the air.

Temperature.—The monthly mean temperatures are: January, 26; February, 26; March, 26.6; April, 27.5; May, 28; June, 27.8; July, 27.1; August, 27.3; September, 27.1; October, 26.8; November, 26.5; and December, 26.2; mean, 26.9. Average coolest months, January and February; absolute minimum temperature recorded in fourteen years, 18.3 in February, 1905; absolute maximum registered during the same period, 34.9 in June, 1912; absolute range of temperature for the period mentioned, 16.6. Yearly mean maximum temperature for a period of eleven years, 30.9; yearly mean minimum for the same period, 23.3; average range of temperature during the year, 7.6° C.

We give in Table C the average distribution of rainfall during the year in places of the third type.

The changes of the most important climatic elements in Aparri and Cebu are graphically represented in Plates V and VI.

From the observations of Aparri and Cebu and from Table C we may deduce the climatic conditions of the third or intermediate type:

First. There is a short period of dry season in the regions of this type, lasting one or two months, generally between January and April, according to the more or less prevalence of wet easterly currents over the place, controlled mostly by the distance from the Pacific. We may consider as dry a month with less than 50 mm. rainfall. Average total rainfall for the year is less than 2,000 mm.

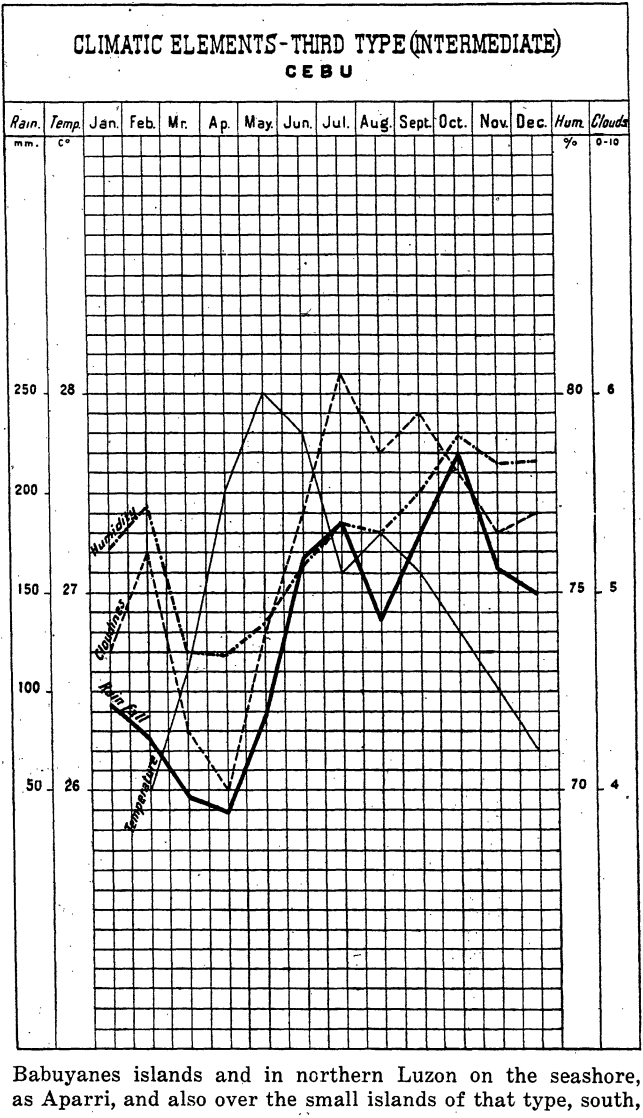
Second. The percentage of rainfall from November to February is less than 20 per cent of the total precipitation for the year. Percentage for the months of June to October very seldom exceeds 60 per cent.

Third. Cloudiness follows the amount of rain, which seems to be uniform during the year except for a short period of less rain; so that the clearest month is, as an average, the least rainy month. The average amount of clouds is less than over the regions of the first type.

Fourth. The relative humidity is lower than the regions of this type south of Luzon. However, the average percentage of each month oscillates in the same manner as the rain.

Fifth. The temperature in this type is generally intermediate on the seashores and high inland where, of course, the altitude above the sea level is below 80 meters. It is mild in the most northerly regions, as in the Batanes and

Plate VI.



Babuyanes islands and in northern Luzon on the seashore, as Aparri, and also over the small islands of that type, south,

TABLE C.—*Table of average monthly rainfall, third type*

Station.	Island.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
		mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
Aparri	Luzon	186.1	81.0	47.6	47.8	122.3	142.1	205.8	246.9	298.0	329.7	304.4	241.8	2,253.5
Bacolod	Negros	111.2	63.9	15.3	24.5	138.6	236.0	413.5	305.2	302.1	256.8	116.2	186.5	2,172.8
Balingasag	Mindanao	75.2	51.7	25.6	21.3	47.8	177.8	241.0	179.0	274.4	225.9	253.6	86.2	1,659.5
Bayombong	Luzon	34.8	29.5	37.6	70.0	164.1	77.2	153.0	124.5	178.0	132.9	107.3	77.3	1,186.2
Calapan	Mindoro	90.1	84.0	87.2	137.4	182.0	231.3	292.2	107.2	207.5	289.2	325.3	195.6	2,229.0
Capiz	Panay	145.5	109.5	23.9	53.9	187.8	297.7	379.6	260.2	324.1	507.7	288.6	262.3	2,840.8
Cagayan	Mindanao	21.5	31.9	46.6	44.5	98.6	169.1	145.5	196.4	217.8	182.7	116.1	168.3	1,439.0
Cebu	Cebu	93.3	76.7	47.2	38.8	87.5	167.6	185.1	136.1	179.8	219.4	162.2	149.0	1,542.7
Cotabato	Mindanao	98.8	88.8	68.1	168.9	218.5	237.3	292.0	271.8	248.6	255.1	231.7	133.5	2,313.1
Davao	do	110.2	141.6	164.2	190.3	252.8	234.2	208.9	207.3	203.6	242.3	176.4	208.8	2,340.7
Dumaguete	Negros	35.3	96.6	14.7	18.8	57.6	167.3	189.7	86.8	123.8	174.6	120.8	53.3	1,139.3
Echague	Luzon	43.6	43.4	40.5	80.4	160.8	105.2	169.7	203.4	175.9	221.2	233.1	142.0	1,639.2
Iloilo	Panay	53.6	29.4	30.2	47.0	131.9	208.7	485.5	363.3	329.7	268.2	208.4	141.7	2,297.6
Isabela	Basilan	54.4	89.2	58.2	89.2	108.0	210.6	208.4	205.8	201.6	261.7	168.4	138.6	1,794.1
Jolo	Jolo	89.1	122.4	85.2	118.2	160.2	203.3	172.0	170.4	184.4	222.9	193.0	144.8	1,865.9
La Carlota	Negros	59.7	55.6	47.4	87.0	229.3	304.8	358.7	378.6	392.9	350.9	199.0	127.3	2,591.2
Masbate	Masbate	133.0	160.5	49.3	45.4	74.1	120.4	217.2	127.3	195.8	137.6	201.4	185.8	1,647.8
Romblon	Romblon	106.9	68.0	49.3	53.7	122.2	161.1	320.8	153.6	194.2	305.7	296.8	227.2	2,059.5
Santa Cruz	Luzon	64.4	47.3	38.1	48.4	131.8	145.0	306.2	289.3	267.2	245.7	183.8	123.9	1,891.1
Tagbilaran	Bohol	83.7	110.7	71.8	194.7	106.7	136.8	292.7	122.5	175.4	281.0	193.9	165.1	1,935.0
Tamontaca	Mindanao	61.4	50.2	128.0	82.8	191.2	312.3	224.8	200.6	293.8	136.5	151.2	76.6	1,909.4
Tayabas	Luzon	135.1	42.2	60.2	23.8	99.3	83.8	96.6	73.9	116.5	239.0	283.2	195.4	1,449.0
Tuburan	Cebu	112.3	67.5	40.9	9.9	59.9	130.7	148.5	99.6	178.1	170.0	153.0	114.5	1,284.9
Tuguegarao	Luzon	32.2	22.2	36.1	74.9	135.4	137.0	265.1	215.9	324.8	287.6	303.1	162.3	1,996.6
Zamboanga	Mindanao	37.2	62.0	21.0	38.2	72.0	88.8	99.0	95.0	106.3	116.1	106.5	84.3	926.4
Mean		82.7	73.0	53.4	72.4	133.6	179.4	243.7	192.8	227.8	242.4	203.2	151.7	1,856.2

as Jolo, and along the seashores benefited by the straits' currents, as Isabela of Basilan, Zamboanga, and Surigao; finally on the western coasts of Samar and Leyte.

The regions which enjoy this type of climate are:

The Batanes and Babuyanes groups.

The extreme north of Luzon.

The Cagayan Valley of Luzon with the slopes east of the Sierra Madre down to Caravallo Sur.

Shores around the Laguna Bay.

Masbate and the islands of the interisland seas.

The northern and eastern coast of Panay.

The islands of Negros, Cebu, and Bohol.

The Gulf of Davao.

The western coast of Mindanao and the south end of the Zamboanga Peninsula. The banks along the Pulangui or great Mindanao River.

These regions are somewhat distant from the Pacific Ocean, and if they are exposed to currents from northeast or east, these currents are modified by the influence of intermediate islands and are not so apt to bring condensation or precipitation.

Climates and agriculture.—The difference of the distribution of rainfall in the various parts of the Archipelago which constitutes the basis for the division of climates in the Philippines is also the principal factor in the diversity of the agricultural products which are or may be obtained in the Islands. By taking advantage of the natural resourses only, some products can be obtained more advantageously in some parts than in others; but by making use of artificial means of irrigation, it is possible to obtain practically all tropical products in one and the same region because the influence of the tropical temperature is uniform enough in all the islands, while the distribution of rain varies greatly in the different epochs of the year and even from year to year in one and same region.

Products such as hemp (abacá), which require a uniform distribution of rain throughout the year without a dry season, grow well in the regions of the first type. Products such as sugar, tobacco, coffee, and cacao, which can resist a short dry season, may be grown with advantage in the regions which have the third type of climate;[1] tobacco can also be grown in the regions of the second type, if the dry season is not of long duration, while with the aid of artificial irrigation the principal products like sugar, tobacco, coffee, and cacao may be obtained in regions of the second type.

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[1] As far as sugar is concerned we may confirm this statement with the experience in a sugar land in the Tropics (West Indies), the island of Barbados. In 1874 Sir R. W. Rawson, governor of the British colony at Barbados, published a colonial report, giving an elaborate study of the dependence of the cane-sugar crop upon the monthly and annual rainfall. Barbados offers an exceptional opportunity for such study, and its latitude

Rice may be and, as a matter of fact, is grown in all the types of climate or in all the islands; it also does very well, especially by duplicating the crops, in regions of the third type and in the other types the crops may be increased by irrigation.

Coconuts do well in all the types of climate, but especially in the first and third.

Apart from this, the variety of the products may be greatly increased in the highlands and even nontropical fruits may be harvested, except fruits such as apples, pears, prunes, etc., which do not bear fruit abundantly because in all three types

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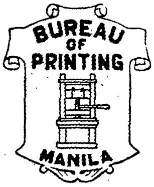
being about 13° N., the results are comparable with those in the Philippines. Moreover, the number of rainfall records averaged more than one to a square mile being 178 for the whole island and for a period of about twenty-five years. "The influence of the rainfall," says Mr. Rawson, (Rawson's Report, p. 33) "in particular months and seasons upon the coming crop is generally felt and admitted, but not known with any certainty. It is believed, writes an experienced agriculturist, that any marked excess of rain during the first six months of the year is injurious both to the crop that is being reaped and to that which is to follow. In ordinary and favorable years, with light showers during the first six months, the young canes make no marked progress, but the roots are increasing in length and strength, and in the months of July and August the plant begins to sucker, as it is called, and to put out the shoots which form the canes, but these make no great progress in length before the end of August and in September and October, when the rains usually come to their aid at the critical time. Then they grow with extreme rapidity, are extremely tender and succulent, and a short spell of dry weather at that time usually does serious mischief. If, however, the first six months of the year are wet, and the young canes are excited to an abnormal rapidity of growth, they are liable to be seriously affected by any interval of dry weather in the middle of the year." These conditions of rainfall distribution seem to be the features of the average monthly rainfall in the third type of climate in the Philippines. In fact, by taking only the rainfall in twelve years of good sugar crop in Barbados out of twenty-five years, we find the following average monthly rainfall: January, 94 mm.; February, 56.1 mm.; March, 36.6 mm.; April, 56.4 mm.; May, 97 mm.; June, 147.3 mm.; July, 142.8 mm.; August, 191.8 mm.; September, 142 mm.; October, 214 mm.; November, 179.3 mm.; and December, 119.6 mm.; total, 1,477.7 mm.

By comparing this result with the mean average distribution of rainfall corresponding to the third type of climate in the Philippines, as given in Table C, we find: First, the total rainfall is greater in the Philippines and this is rather favorable to sugar production; second, the distribution of rainfall seems to be more suitable to cane development as the amount of rain during the first six months of the year in the Philippines in only 22 per cent of the total annual rainfall, while in Barbados is 33 per cent; finally, more abundant rains occur in the Philippines in July, August, September, and specially in October, which are the critical months, the sugar crop being benefited by it.

of climate there are periods which have an amount of rain in excess of what these plants can bear.

Hence, the highlands of Abra, Bontoc, Benguet, and Tayabas in Luzon, of Mindoro, the tablelands of Bukidnon, of the high Agusan, Pulangui, and Lanao, and of the Lakes Siguasan, Butuan, and Cebu, recently discovered, are excellent for a great variety of tropical and nontropical agricultural products.

Cyclones.—Exposure with more or less frequency to tropical cyclones of a country can make it more or less desirable, so it will be interesting to say, at the end, a few words on the way these storms affect the different regions of the Archipelago. Unfortunately, all the regions of the three types of climate are exposed to cyclones and their frequency depends mostly on the latitude of the place. As a matter of fact and as the result of long years of experience, we may briefly say that the southern part of the Archipelago up to 8° latitude N. is nearly free from cyclones, as these storms are rare there and number only about 5 per cent of the storms that cross the Archipelago. It makes the agricultural lands of nearly the whole of Mindanao exceedingly valuable. From 8° N. to about 11° N., of over a zone 180 miles wide, the cyclones are a little more frequent or about 10 per cent of the storms which visit the Islands; this leaves nearly undisturbed the great sugar lands of Negros and southern Panay. From 11° N. to 13° 30′ N. the cyclones are very frequent and often destructive and are about 30 per cent of the cyclones affecting the Archipelago. North of that zone there is another zone more than 100 miles wide less visited by cyclones as they are only 20 per cent of the cyclones for the year. Finally, the northern part of the Archipelago up to Formosa is the most visited by cyclones. About 35 per cent visit that region. In the map Plate A we show graphically the different zones affected by cyclones and their frequency.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